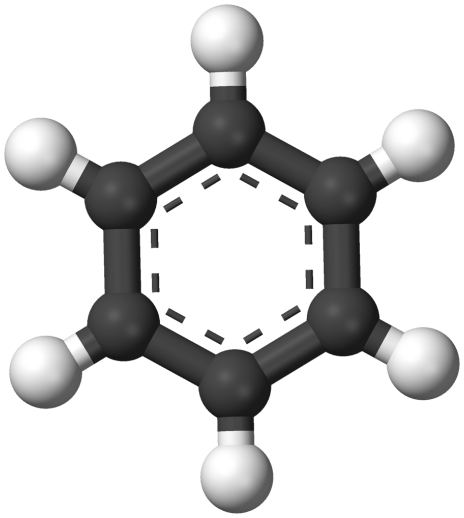
Building a Benzene Sensor

April 13, 2023

Introduction

Air quality monitoring is an important issue that affects public health and the environment. One of the pollutants that can be present in the air is Benzene, a toxic gas that can cause respiratory problems and even cancer. Benzene is a volatile organic compound (VOC) that is commonly found in gasoline, tobacco smoke, and industrial emissions. In this project, we will use an MQ-135 sensor and an Arduino to detect the presence of Benzene in the air, which can help raise awareness about the importance of air quality monitoring and pollution control.



Background

The MQ-135 sensor is a gas sensor that can detect a variety of gasses, including Benzene, Ammonia, Carbon Monoxide, and others. It operates based on the principle of gas sensing, where the gas molecules interact with the sensing element of the sensor and change its resistance. The change in resistance is then converted into an electrical signal that can be read by the Arduino.

The Arduino is a popular microcontroller that can be programmed to perform a variety of tasks, including reading sensor data, controlling actuators, and communicating with other devices. The Arduino IDE (Integrated Development Environment) is used to write, upload, and monitor code on the Arduino board.

The Serial Monitor is a built-in tool in the Arduino IDE that allows you to view and debug data sent from the Arduino board through the serial communication port. This tool is useful for monitoring sensor values, debugging code, and testing the communication between the Arduino

board and other devices. By using the Serial Monitor, we can view the analog values from the MQ-135 sensor and interpret them to detect the presence of Benzene in the air.

What You Will Learn

In this project, you will learn:

- How to connect an MQ-135 sensor to an Arduino.
- How to read analog values from the sensor using the Arduino.
- How to use the Serial Monitor to display sensor values.
- How to interpret sensor values to detect the presence of Benzene in the air.

By the end of this project, you will have a basic understanding of air quality monitoring and be able to apply this knowledge to build more advanced air quality monitoring systems.

Materials

You will need:

- Arduino Uno
- MQ-135 air quality sensor
- Breadboard
- Jumper wires

Instructions

1. Connect the MQ-135 sensor to the breadboard by inserting the pins into the appropriate slots on the breadboard.
2. Connect the VCC pin of the MQ-135 to the 5V pin on the Arduino.
3. Connect the GND pin of the MQ-135 to the GND pin on the Arduino.
4. Connect the AO pin of the MQ-135 to the A0 pin on the Arduino.
5. Open the Arduino IDE on your computer and create a new sketch. Copy and paste the following code into the sketch:

```
int sensorValue; // define a variable to store sensor values

void setup() {
  Serial.begin(9600); // initialize serial communication
}

void loop() {
  sensorValue = analogRead(A0); // read analog value from sensor
  Serial.print("Benzene Level: "); // print text to the Serial Monitor
  Serial.println(sensorValue); // print sensor value to the Serial Monitor
  delay(1000); // wait for 1 second
}
```

6. Verify and upload the code to the Arduino board.
7. Open the Serial Monitor in the Arduino IDE by clicking on the magnifying glass icon on the top right corner of the window.
8. Set the baud rate to 9600 and wait for the sensor to warm up.
9. Place the MQ-135 sensor in a location where you suspect there may be Benzene in the air.
10. Observe the values on the Serial Monitor. If the value is high, there may be Benzene present in the air.

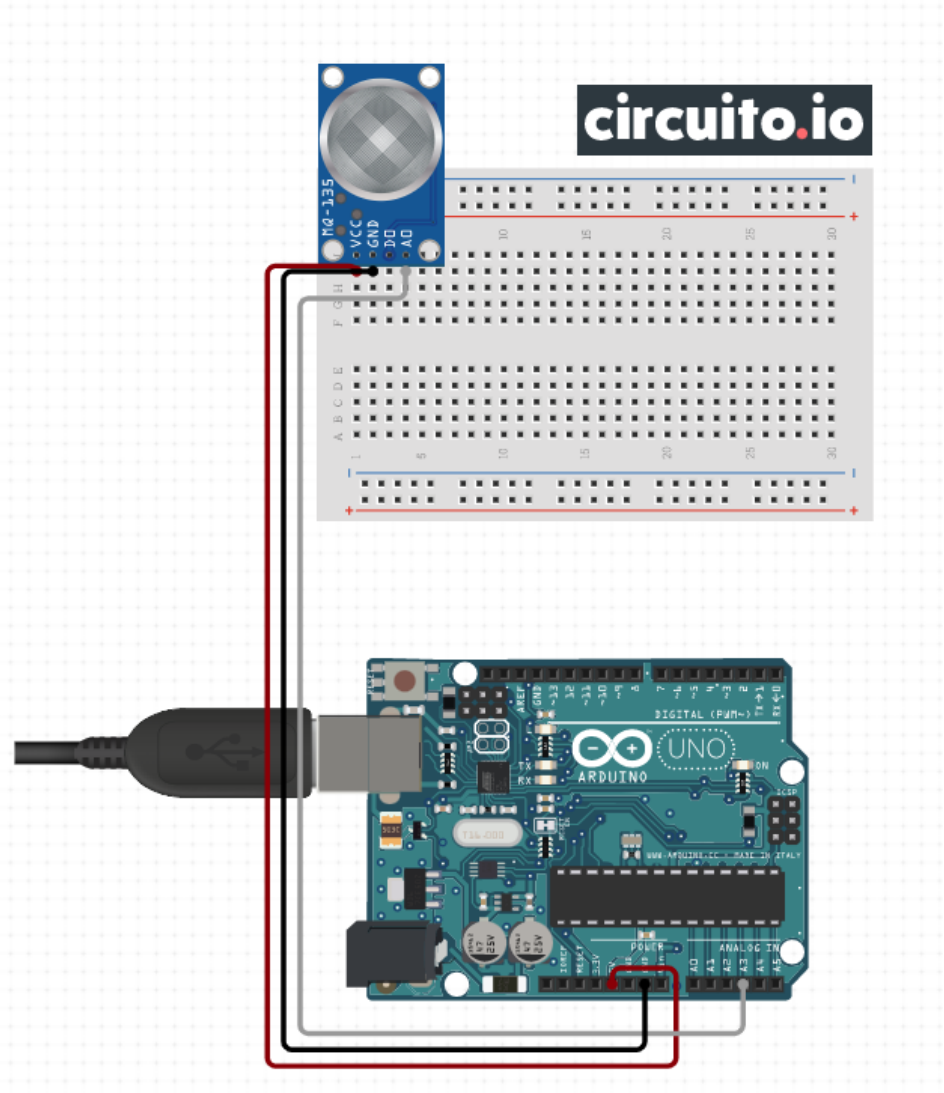
Note: The sensor may require calibration for accurate readings. Consult the sensor's datasheet for calibration instructions.

Understanding the readout:

- Analog value of 0-200: Low or no concentration of Benzene.
- Analog value of 200-500: Moderate concentration of Benzene.
- Analog value of 500-700: High concentration of Benzene.
- Analog value of 700-1023: Very high concentration of Benzene.

Wiring Diagram

Connect the MQ-135 sensor to the breadboard (white board with holes with red and blue stripes) using the following wiring diagram. Remember: Black is Ground (Negative) and Red is Positive (Source). You'll need to connect the USB cable (shown in black) to your computer. The Arduino will flash a green light to let you know the program is running!



Questions

1. What is the principle of gas sensing and how does it relate to the operation of the MQ-135 sensor?

2. What are some common sources of Benzene in the environment, and how can the MQ-135 sensor be used to detect its presence in the air?

3. What is the purpose of the delay function in the code, and how does changing the delay time affect the readings of the MQ-135 sensor?

4. Can the MQ-135 sensor be used to detect other types of gasses besides Benzene? If so, what are some examples of other gasses it can detect?

5. How can the information obtained from the MQ-135 sensor and the Serial Monitor be used to raise awareness about air pollution and the importance of air quality monitoring?